Friday, November 18, 2016 9:32 AM

Wednesday, November 16, 2016
9:55 AM

p58

Planet	log r	log T	
mercury	10.76	6.88	

Log y = x $y=10^x$
Log 10 = 1
log 1000 = 3
log 10^{16} = 16
graph log r vs log T

Fc = Fg

$$\frac{GMm}{r^2} = \frac{mv^2}{r}$$

$$r^3 = \frac{GM}{4\pi^2} T^2$$

$$\log r^3 = \log\left(\frac{GM}{4\pi^2} T^2\right)$$

$$3 \log r = \log\left(\frac{GM}{4\pi^2}\right) + 2 \log T$$

$$3\log r = \log\left(\frac{GM}{4\pi^2}\right) + 2\log T$$

$$\log r = \frac{1}{3}\log\left(\frac{GM}{4\pi^2}\right) + \frac{2}{3}\log T$$

y-intercept → slope

% error for M vs $M_s = 1.98 \times 10^{30}$ kg

% error

$$y = \frac{1}{3}\log\left(\frac{GM}{4\pi^2}\right)$$

$$3y = \log\left(\frac{GM}{4\pi^2}\right)$$

$$10^{3y} = \frac{GM}{4\pi^2}$$

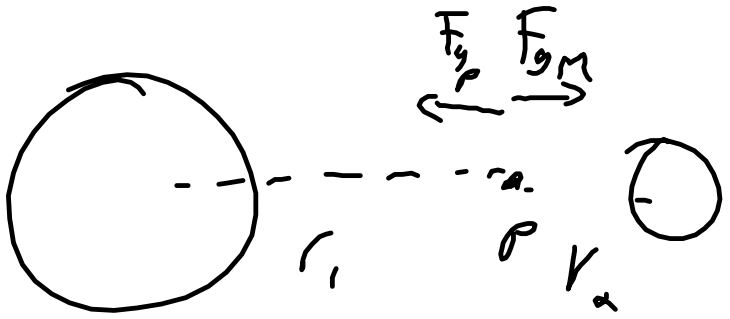
$3y$ ← off graph

$$\underline{M} = \frac{4\pi^2 10^{3y}}{G}$$

or ← lab book

Practice problems 1, 2, 4

Bonus 5



$d = r_1 + r_2$

Quiz

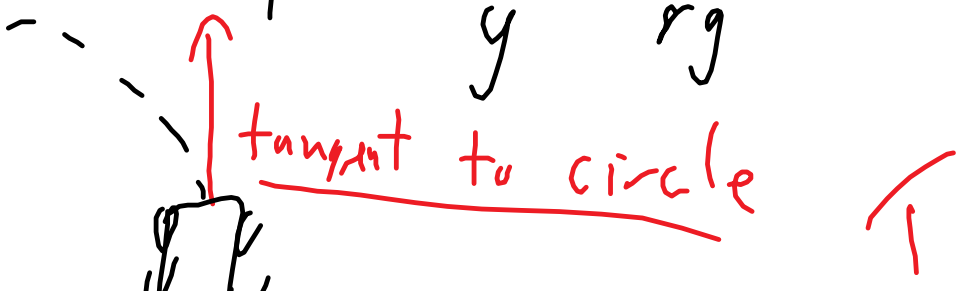
1a) $a = \frac{v^2}{r} =$

b) $F_f = F_C$

$\mu mg = m\frac{v^2}{r}$

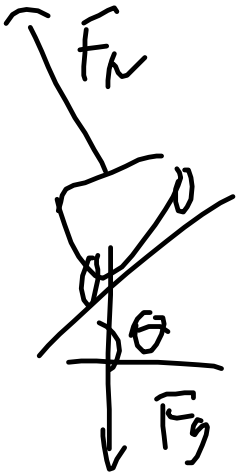
$\mu = \frac{a}{g} = \frac{v^2}{rg}$

c)



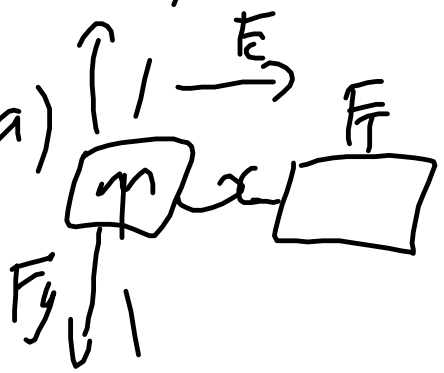
c)

d)



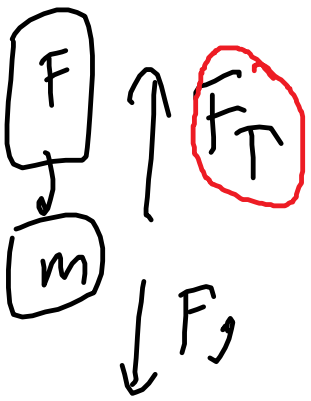
$$\tan\theta = \frac{ma}{mg} = \frac{v^2}{rg}$$

2 a)



$$F_C = \frac{4\pi^2 r}{T^2} m =$$

b)



$$F_C = F_{net} = F_T - F_g$$

$$F_T = m\frac{4\pi^2 r}{T^2} + mg$$

c)

$$F_g = F_C$$

$$\frac{mv^2}{r} = mg \qquad v = \sqrt{rg}$$

3 a) $F_g = \frac{GM_p m_m}{r^2}$ $\qquad r = r_p + h$

b) $m\frac{v^2}{r} = \frac{GM_p m}{r^2}$ $\qquad v = \sqrt{\frac{GM_p}{r}}$

c) $m\frac{4\pi^2 r}{T^2} = \frac{GM_p m}{r^2}$

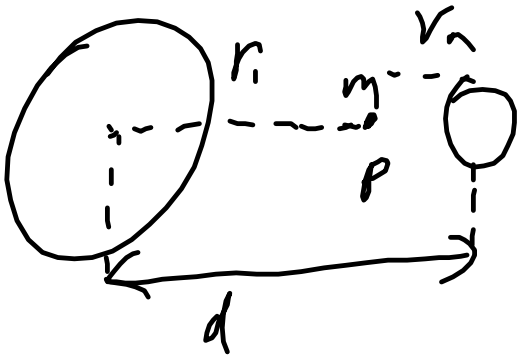
$$T = \sqrt{\frac{4\pi^2 r^3}{GM}}$$

or $T = \frac{d}{v} = \frac{2\pi r}{v}$

d) $\boxed{g} = \frac{F_g}{m} = \frac{GM_p}{r^2} = 0 \frac{N}{kg}$

$p \nwarrow r_p$

e)



$$F_{g_p} = F_{g_M}$$

$$\frac{G M_p}{r_1^2} = \frac{G M_m}{r_2^2}$$

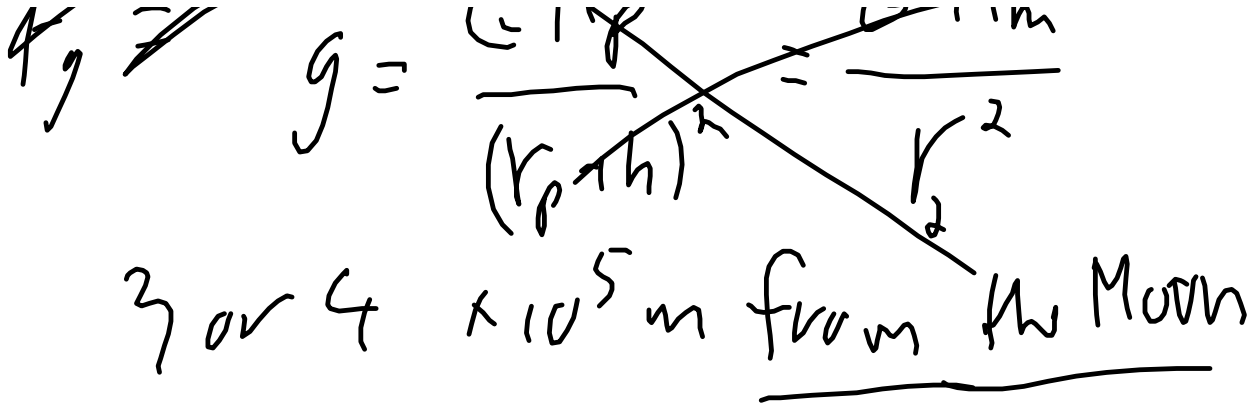
$$M_p (r_2^2) = M_M (d - r_2)^2$$

$$\frac{M_p}{M_m} x^2 = d^2 - 2xd + x^2$$

$$\left(1 - \frac{M_p}{M_m}\right) x^2 - 2xd + d^2 = 0$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad \frac{2d \pm \sqrt{4d^2 - 4\left(1 - \frac{M_p}{M_m}\right) d^2}}{2\left(1 - \frac{M_p}{M_m}\right)}$$

$$F_g = \frac{G M_m}{} \qquad g = \frac{G M_p}{} = \frac{G M_m}{}$$



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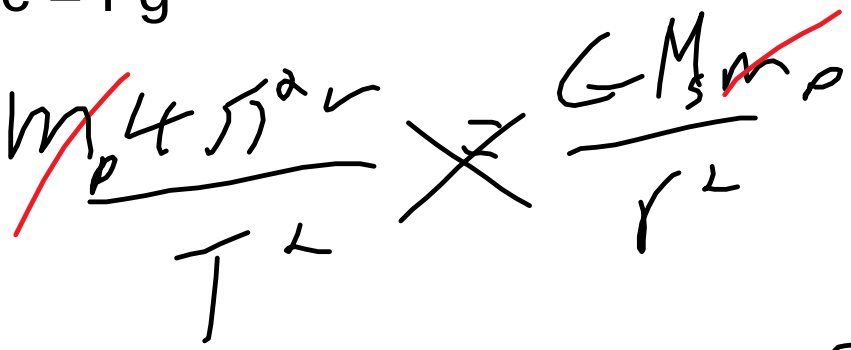
Planet?	log r	log T	
mercury	10.76	6.88	

Log y = x $y=10^x$
Log 10 = 1
log 1000 = 3
log 10^{16} = 16
graph log r vs log T
log x^y = ylogx
log (xy) = log x + log y
Fc = Fg



$$4\pi^2 r^3 = GM_s T^2$$

$$r^3 = \frac{GM_s}{4\pi^2} T^2$$

$$\log(r^3) = \log\left(\frac{GM_s}{4\pi^2}\right)(T^2)$$

$$3\log r = 2\log T + \log\left(\frac{GM_s}{4\pi^2}\right)$$

$$\log r = \frac{2}{3}\log T + \frac{1}{3}\log\left(\frac{GM_s}{4\pi^2}\right)$$

slope
% error

y-intercept
y

$$y = \frac{1}{3}\log\left(\frac{GM_s}{4\pi^2}\right)$$

$$3y = \log\left(\frac{GM_s}{4\pi^2}\right)$$

$$10^{3y} = \frac{GM_s}{4\pi^2}$$

y-intercept

$$M_S = \frac{4\pi^2 10^3 y}{G}$$

% error relative to $M_S = 1.98 \times 10^{30}$ kg

labbook p 65 problems 1,2,4, bonus: 5

$$\frac{M_p}{M_m} = \frac{(d - r_1)^2}{r_1^2}$$

$$\sqrt{\frac{M_p}{M_m}} = \frac{d - r_1}{r_1}$$

$$\sqrt{\frac{M_p}{M_m}}\, r_1 = d - r_1$$

$$\left(\sqrt{\frac{M_p}{M_m}} + 1\right) r_1 = d$$

4.55×10^7

$$r_1 = \frac{4.55 \times 10^{7}}{\sqrt{\frac{6.50 \times 10^{25}}{3.4 \times 10^{21}} + 1}}$$

$$r_1 = 3.3 \times 10^{5}\ \text{m}$$